



PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.: 10/623,991
Filing Date: July 21, 2003
Applicant: Volker Formanski et al.
Group Art Unit: 1745
Examiner: Thomas H. Parsons
Title: GAS HUMIDIFICATION FOR CATHODE SUPPLY OF A PEM FUEL CELL
Attorney Docket: 8540G-000163 (GP-302842)

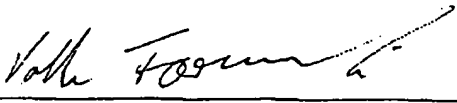
DECLARATION UNDER 37 C.F.R. 1.131

The undersigned hereby declare that:

1. We are joint inventors who made application for a patent on July 21, 2003 which is the subject of the present application.
2. We conceived and reduced our invention to practice in Germany prior to January 27, 2003, the filing date of United States Patent Application Publication 2003/0219636.
3. We conceived of and reduced our invention to practice in Germany as evidence by the disclosure materials attached as Exhibit A. This written description was made prior to January 27, 2003.

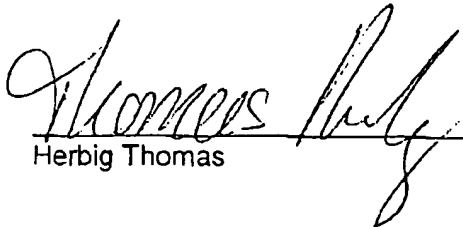
Each of the undersigned hereby declare that the statements made herein of his own knowledge are true and that the statements made on information and belief are

believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 the United States Code, and that such willful false statement may jeopardize the validity of the application, and any patent issuing thereon, or any patent to which this declaration is directed.



Volker Formanski

02. January 2007
Date



Herbig Thomas

04. January 2007
Date

EXHIBIT A

37 C.F.R. §1.131 Declaration of Volker Formanski and Herbig Thomas
U.S.S.N. 10/623,991 entitled "Gas Humidification for Cathode
Supply of a PEM Fuel Cell"

System Modeling

humidification with water injection (concept of H2 Vehicle):

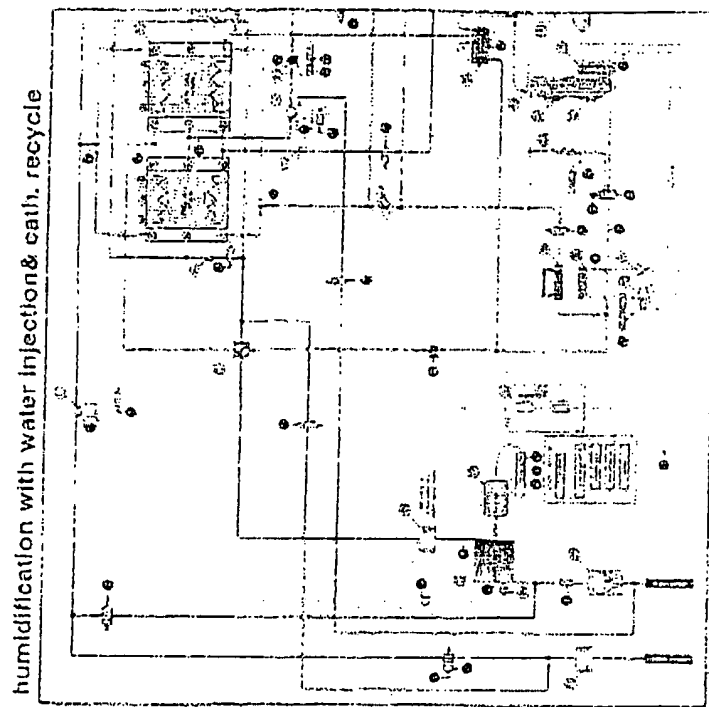
- *advantages:*
 - water neutral system by providing $RH_{C, \text{sat}} > 100\%$
- *disadvantages:*
 - limited controllability of humidification and temperature
 - limited humidification capability

humidification with cath. recycle (concept of H3 Vehicle) :

- **advantages:**
 - simple realization
- **disadvantages:**
 - increasing compressor power with increasing recycle-flow
 - reduced oxygen partial pressure(=> red. Stack performance)
 - max. RH values of aprox. 20 % realistic

humidification with water injection & cath. recycle:
(H4 system concept No. 9)

- **advantages:**
 - water neutral system by providing $RH_{C, out} > 110\%$
 - simple realization
 - independent controllability of humidification and temperature
 - almost any RH value can be adjusted
- **disadvantages:**
 - increasing compressor power with increasing recycle flow
 - reduced oxygen partial pressure(=> red. Stack performance)



cathode gas humidification by combination of cathode recycle and water injection

humidification with water injection (concept of H2 Vehicle):

- advantages:
- water neutral system by providing $RH_{C,out} > 110\%$

humidification with cath. recycle (concept of H3 Vehicle) :

- advantages:
- simple realization

humidification with water injection & cath. recycle:

(H4 system concept No. 9)

- advantages:
- water neutral system by providing $RH_{C,out} > 110\%$
- simple realization
- independent controllability of humidification and temperature
- almost any RH value can be adjusted

humidification with water injection & cath. recycle

